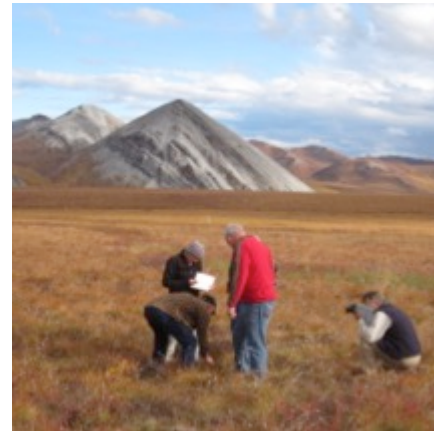


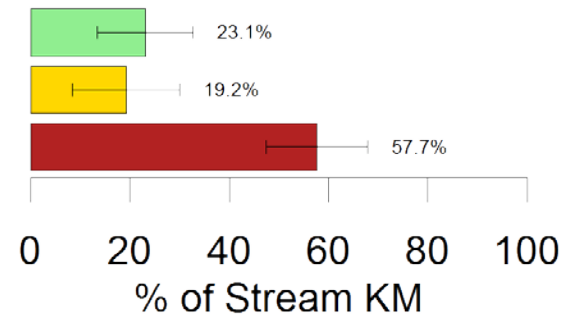
Understanding and Setting Confidence Interval Levels for Monitoring



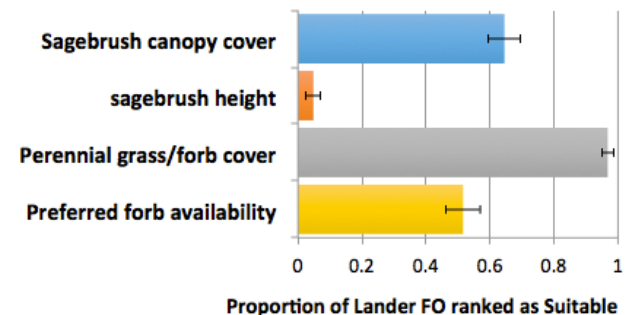
What are confidence intervals?

- A range of values for an indicator created from a sample
- Actual indicator value has a known probability of being within that range
 - E.g., 90% confidence interval
- You can choose your CI level!
 - Too low (narrow CI) = potential false alarms
 - Too high (wide CI) = potential to miss change/effect

Percent of Stream KM in
Instream Biological
Integrity Classes



Summer Habitat Indicators



Two types of monitoring decision errors

		Actual Ground Condition	
		Change/Difference	No Change/Difference
Sample Estimated Condition	Change/Difference	Correct:	Type I Error (α): False Change
	No Change/Diff.	Type II Error (β): Missed Change	Correct: No Problems!

How to choose appropriate confidence interval widths?

- There are costs/consequences of making different types of error
 - Airport security analogy
- Error costs/consequences for rangeland monitoring are real and quantifiable
 - Often not difficult to do (or at least approximate)
 - But vary by scale and application
- **Costs/consequences should be the basis for setting confidence interval levels**

Accounting for costs & consequences

Error costs can be quantified



Type I Error Cost Examples

- Additional monitoring costs
- Lost use (e.g., AUMs)
- Loss of credibility
- Litigation costs
- ...

Type II Error Cost Examples

- Loss of land potential/productivity
- Long-term loss of use
- Cross thresholds in land condition
- Species invasions
- ...

Costs can be calculated in different units

- Choose a unit of cost of cost that makes sense to you (dollars, hours, forage production, AUMs, ...).
- Just need to be consistent.
- Sometimes easier to think in ratios rather than absolute costs.

Scenario: Watershed Assessment

Indicator: proportion of watersheds with sites having large (>2m) canopy gaps

Mgmt objective: Limit areas with large canopy gaps to less than 20% of watershed.

Actual Ground Condition		Conclusion	Action
Threshold Met	Threshold Not Met		
Sample Estimated Condition	Threshold Met	>20% with large canopy gaps Correct: Problem!	>20% with large canopy gaps Type I Error: False Change
	Threshold Not Met	<20% with large canopy gaps Type II Error: Missed Change	<20% with large canopy gaps Correct: No Problems!

Type II Errors are more problematic than Type I Errors

Error rates should reflect this.

Scenario: Allotment Land Health

Indicator: proportion of allotment with less than 10% perennial grass cover

Mgmt objective: limit areas with low P.G. cover to less than 20% of allotment.

		Actual Ground Condition			Conclusion	Action/Conseq.
		Threshold Met	Threshold Not Met			
Sample Estimated Condition	Threshold Met	>20% Allotment with low PG cover Correct: Problem!	>20% Allotment with adequate PG cover Type I Error: False Change		Land health standard <u>not</u> being met	Grazing mgmt change: e.g., temp reduction in AUMs. Follow-up monitoring
	Threshold Not Met	<20% Allotment with adequate PG cover Type II Error: Missed Change	<20% Allotment with adequate PG cover Correct: No Problems!		Land health standard <u>is</u> being met	No action. Permanent loss of productivity (AUMs) if wrong

Type I errors affect user, Type II errors affect the resource